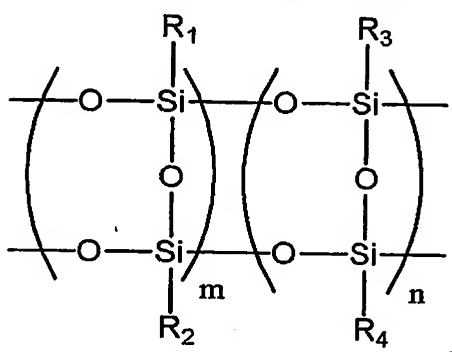
CLAIMS

1. An organic semiconductor device having an electrode for bias application, comprising: a substrate, an organic semiconductor, an insulator; and a conductor, wherein at least one compound constituting the insulator has a silsesquioxane skeleton of the Formula 1:



...(1)

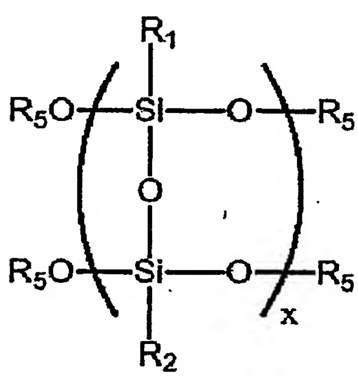
where R_1, R_2, R_3, and R_4 each represent one of a substituted or unsubstituted alkyl group having 1 to 5 carbon atoms and a substituted or unsubstituted phenyl group, and R_1, R_2, R_3, and R_4 may be the same functional group or functional groups different from one another, m and n each represent an integer of 0 or more, and the sum of m and n is an integer of 1 or more, the skeleton may be of a random copolymer or a block copolymer.

2. The organic semiconductor device according to claim 1, wherein the conductor of the organic semiconductor device comprises a gate electrode, a source electrode, and a drain electrode, the

insulator comprises a gate insulating layer, and at least one compound constituting the gate insulating layer has the silsesquioxane skeleton of the Formula 1.

3. The organic semiconductor device according to claim 2, wherein the gate insulating layer has a thickness of 50 nm or more and 250 nm or less.

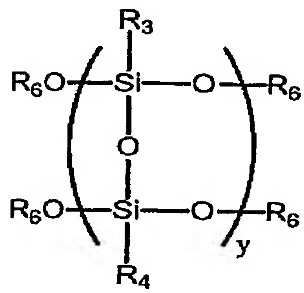
4. A method of manufacturing an organic semiconductor device, comprising the steps of: coating a substrate with a solution containing at least one of polyorganosilsesquioxane compounds of the Formula 2 and/or Formula 3; and drying the solution at a temperature of 200°C or lower to form the insulator of the organic semiconductor device according to claim 1,



…(2)

where R_1 and R_2 each represent one of a substituted or unsubstituted alkyl group having 1 to 5 carbon atoms and a substituted or unsubstituted phenyl group, and R_1 and R_2 may be the same functional group, R_5

represents one of an alkyl group having 1 to 4 carbon atoms and a hydrogen atom, and x is an integer of 1 or more,



…(3)

where R_3 and R_4 each represent one of a substituted or unsubstituted alkyl group having 1 to 5 carbon atoms and a substituted or unsubstituted phenyl group, and R_3 and R_4 may be the same functional group, R_6 represents one of an alkyl group having 1 to 4 carbon atoms and a hydrogen atom, and y is an integer of 1 or more.

5. The method of manufacturing an organic semiconductor device according to claim 4, wherein the solution containing the polyorganosilsesquioxane compound further contains formic acid.

6. The method of manufacturing an organic semiconductor device according to claim 4, wherein the gate insulator is formed by the coating step and drying step of a precursor solution.

7. The method of manufacturing an organic semiconductor device according to claim 4, wherein a

refractive index of the gate insulator at a wavelength of 632 nm after the drying step is reduced by 0.015 or more from that before the drying step.

8. The organic semiconductor device according to claim 1, further comprising a substrate, a gate insulating layer, a gate electrode; a source electrode, a drain electrode, and an organic semiconductor layer, wherein the gate insulating layer contains a compound having a silsesquioxane skeleton of the Formula 1 and an inorganic compound particle which is dispersed into the compound and does not have ferroelectricity of a relative dielectric constant of 5 or more.

9. The organic semiconductor device according to claim 8, wherein the gate insulating layer has a thickness of 50 nm or more and 250 nm or less.

10. The method of manufacturing an organic semiconductor device, comprising the steps of: coating a substrate with a dispersion prepared by dispersing an inorganic compound particle having no ferroelectricity into a solution containing at least one of polyorganosilsesquioxane compounds of the Formula 2 and/or Formula 3; and drying the dispersion at a temperature of 200°C or lower to form the gate insulating layer of the organic semiconductor device according to claim 8.

11. The method of manufacturing an organic

semiconductor device according to claim 10, wherein the solution containing the polyorganosilsesquioxane compound further contains formic acid.

12. An organic semiconductor apparatus formed of the organic semiconductor device according to claim 1.

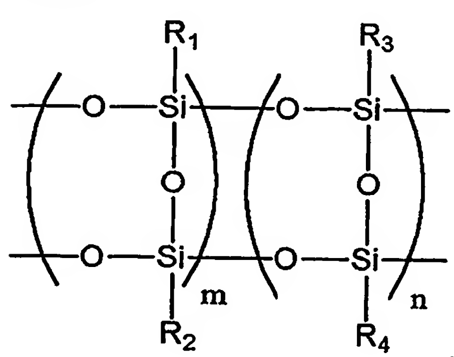
13. An organic semiconductor device comprising: a substrate, an organic semiconductor, a gate insulator, a gate electrode, a source electrode, and a drain electrode, wherein

(1) at least one compound constituting the gate insulator has a silsesquioxane skeleton of the Formula 1;

(2) the gate insulator has a thickness of 50 nm or more and 250 nm or less;

(3) the gate insulator is formed by a coating step and a drying step of a precursor solution; and

(4) the refractive index of the gate insulator at a wavelength of 632 nm after the drying step is reduced by 0.015 or more from that before the drying step,



...(1)

where R_1, R_2, R_3, and R_4 each represent one of a substituted or unsubstituted alkyl group having 1 to 5 carbon atoms and a substituted or unsubstituted phenyl group, and R_1, R_2, R_3, and R_4 may be the same functional group or functional groups different from one another, m and n each represent an integer of 0 or more, and the sum of m and n is an integer of 1 or more, the skeleton may be of a random copolymer or a block copolymer.

14. An organic semiconductor apparatus formed of the organic semiconductor device according to claim 13.